

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 14 August 2001 (14.08.01)	
International application No. PCT/US00/25793	Applicant's or agent's file reference 4686/00005
International filing date (day/month/year) 20 September 2000 (20.09.00)	Priority date (day/month/year) 20 September 1999 (20.09.99)
Applicant COLSON, Wendell, B. et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
 09 February 2001 (09.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

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made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Antonia Müller Telephone No.: (41-22) 338.83.38
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**PCT**

**NOTIFICATION OF THE RECORDING  
 OF A CHANGE**

(PCT Rule 92bis.1 and  
 Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

LINEK, Ernest, V.  
 Banner & Witcoff, Ltd.  
 28th floor  
 28 State Street  
 Boston, MA 02109  
 ETATS-UNIS D'AMERIQUE

Date of mailing (day/month/year) 15 janvier 2002 (15.01.02)		<b>BEST AVAILABLE COPY</b>
Applicant's or agent's file reference 4686/00005		
International application No. PCT/US00/25793	International filing date (day/month/year) 20 septembre 2000 (20.09.00)	

1. The following indications appeared on record concerning: <input checked="" type="checkbox"/> the applicant <input type="checkbox"/> the inventor <input type="checkbox"/> the agent <input type="checkbox"/> the common representative		
Name and Address	State of Nationality	State of Residence
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning: <input checked="" type="checkbox"/> the person <input type="checkbox"/> the name <input type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence		
Name and Address HUNTER DOUGLAS INDUSTRIES BV 2 Piekstraat NL-3071 EI Rotterdam Netherlands	State of Nationality NL	State of Residence NL
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary: <b>Addition of an applicant for all designated States except the US.</b>		
4. A copy of this notification has been sent to: <input checked="" type="checkbox"/> the receiving Office <input type="checkbox"/> the designated Offices concerned <input type="checkbox"/> the International Searching Authority <input checked="" type="checkbox"/> the elected Offices concerned <input type="checkbox"/> the International Preliminary Examining Authority <input type="checkbox"/> other:		

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Sean Taylor Telephone No.: (41-22) 338.83.38
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## INTERNATIONAL SEARCH REPORT

International Application No

CT/US 00/25793

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B29C53/80 B65H81/00 D04H3/07 D04H3/04 D04H3/12  
D06H7/08 B63H9/06 B29C70/30 B29C70/50 B32B27/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B29C B65H D04H D06H B63H B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 00 41523 A (HUNTER DOUGLAS IND BV ;HARTMAN DAVID (US); SWISCZ PAUL (US); HUNTE) 20 July 2000 (2000-07-20) cited in the application claims 35-47,53-67,95-99,103-114,128,129 figures 1,2,8-11,62-70 ---	1-18
A	US 4 511 424 A (USUI FUMIO) 16 April 1985 (1985-04-16) column 9, line 45 - line 61; figures 2,4-10	9-16
Y	---	1-8,17, 18
Y	US 2 797 728 A (G. SLAYTER ET AL) 2 July 1957 (1957-07-02) column 3, line 16 - line 20 column 6, line 62 - line 74 ---	1-8,17, 18
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

12 March 2001

Date of mailing of the international search report

08. 02. 2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Barathe, R

## INTERNATIONAL SEARCH REPORT

International Application No

CT/US 00/25793

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 80 02850 A (HONDA T) 24 December 1980 (1980-12-24) figures 2,3 ---	1-18
A	US 3 663 331 A (SOLBECK ERIK) 16 May 1972 (1972-05-16) figure ---	1-18
A	US 3 591 434 A (HARTSTEIN FRED W) 6 July 1971 (1971-07-06) the whole document ---	9-16
A	US 4 411 722 A (YAZAWA DECEASED MASAhide ET AL) 25 October 1983 (1983-10-25) figures ---	9-16
A	US 4 265 691 A (USUI FUMIO) 5 May 1981 (1981-05-05) figures ---	1-8,17, 18
A	US 5 097 783 A (LINVILLE JAMES C) 24 March 1992 (1992-03-24) the whole document ---	9-16
A	US 5 061 545 A (PREVORSEK DUSAN C ET AL) 29 October 1991 (1991-10-29) figure 10 ---	9-16
A	EP 0 885 803 A (MCGHEE JAMES M) 23 December 1998 (1998-12-23) the whole document -----	13-16

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

CT/US 00/25793

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 0041523	A	20-07-2000	AU	3692500 A	01-08-2000
US 4511424	A	16-04-1985	JP	57197126 A	03-12-1982
			AU	8459582 A	07-12-1982
			DE	3248309 T	28-07-1983
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US 2797728	A	02-07-1957	BE	505476 A	
			CH	296322 A	15-02-1954
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			AT	333407 B	25-11-1976
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			DE	2030203 A	15-04-1971
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			NO	126140 B	27-12-1972
			SE	373888 B	17-02-1975
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			FR	1595577 A	15-06-1970
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			JP	50083567 A	05-07-1975
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			JP	57047779 B	12-10-1982
			CA	1111631 A	03-11-1981
			DE	2846523 A	27-09-1979
			FR	2420589 A	19-10-1979
			GB	2016543 A	26-09-1979
US 5097783	A	24-03-1992	US	4945848 A	07-08-1990
US 5061545	A	29-10-1991	CA	2003805 A	28-05-1990
			EP	0445222 A	11-09-1991
			JP	4502185 T	16-04-1992

# INTERNATIONAL SEARCH REPORT

mation on patent family members

International Application No

CT/US 00/25793

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5061545 A		WO 9006387 A	14-06-1990
EP 0885803 A	23-12-1998	NONE	

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>					
IPC 7	B29C53/80	B65H81/00	D04H3/07	D04H3/04	D04H3/12
	D06H7/08	B63H9/06	B29C70/30	B29C70/50	B32B27/12
According to International Patent Classification (IPC) or to both national classification and IPC					
<b>B. FIELDS SEARCHED</b>					
Minimum documentation searched (classification system followed by classification symbols)					
IPC 7 B29C B65H D04H D06H B63H B32B					
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched					
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)					
EPO-Internal, WPI Data, PAJ					
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>					
Category *	Citation of document, with indication, where appropriate, of the relevant passages				Relevant to claim No.
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* Special categories of cited documents :					
"A" document defining the general state of the art which is not considered to be of particular relevance			"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention		
"E" earlier document but published on or after the international filing date			"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone		
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)			"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.		
"O" document referring to an oral disclosure, use, exhibition or other means			"8" document member of the same patent family		
"P" document published prior to the international filing date but later than the priority date claimed					
Date of the actual completion of the international search			Date of mailing of the international search report		
12 March 2001			08. 02. 2001		
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016			Authorized officer  Barathe, R		

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International Application No.

PCT/US 00/25793

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US 5061545	A	29-10-1991	CA	2003805 A	28-05-1990
			EP	0445222 A	11-09-1991
			JP	4502185 T	16-04-1992

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/US 00/25793

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5061545 A		WO 9006387 A	14-06-1990
EP 0885803 A	23-12-1998	NONE	

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number  
**WO 01/21383 A1**

(51) International Patent Classification<sup>7</sup>: **B29C 53/80**,  
B65H 81/00, D04H 3/07, 3/04, 3/12, D06H 7/08, B63H  
9/06, B29C 70/30, 70/50, B32B 27/12, B29C 67/14

(21) International Application Number: PCT/US00/25793

(22) International Filing Date:  
20 September 2000 (20.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/154,717 20 September 1999 (20.09.1999) US

(71) Applicant (for all designated States except US): **HUNTER DOUGLAS INC.** [US/US]; 2 Parkway, Upper Saddle River, NJ 07458-0740 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **COLSON, Wendell, B.** [US/US]; 12 Tech Circle, Natick, MA 01760 (US). **SWISZCZ, Paul, G.** [US/US]; 12 Tech Drive, Natick, MA 01760 (US).

(74) Agents: **LINEK, Ernest, V. et al.**; Banner & Witcoff, Ltd., 28th floor, 28 State Street, Boston, MA 02109 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

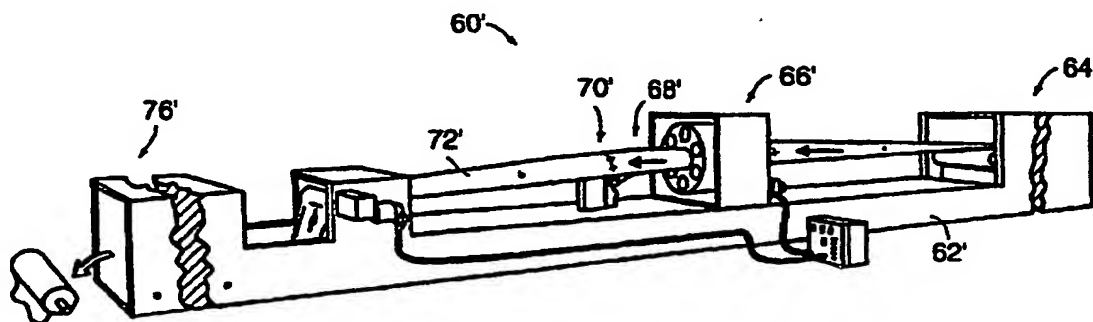
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- With international search report.
- Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **NON-WOVEN COMPOSITE FABRIC AND METHOD AND APPARATUS FOR MANUFACTURING SAME**



(57) Abstract: An apparatus for fabricating a unique non-woven fabric which has the appearance of a woven fabric includes a supply station for adhesive coated parallel warp yarns, a support structure for orienting the parallel warp yarns into a cylindrical orientation with the adhesive coating on the outside, a weft yarn applicator for wrapping weft yarns around the cylindrically oriented warp yarns, a heating station for activating the adhesive and a cooling station for setting the adhesive, and a cutter for severing the cylindrically formed fabric composite so that it can be flattened and wrapped onto a take-up roller. The weft yarn applicator includes a rotating drum wherein a plurality of spools of weft yarn material are mounted in circumferentially spaced relationship. Tension on the weft yarns is provided by the rotation of the drum (centrifugal force) and a stationary conical aligner is used to guide the weft yarn material onto the warp yarns in substantially perpendicular alignment.

WO 01/21383 A1

REVISED VERSION

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number  
**WO 01/21383 A1**

(51) International Patent Classification<sup>7</sup>: B29C 53/80,  
B65H 81/00, D04H 3/07, 3/04, 3/12, D06H 7/08, B63H  
9/06, B29C 70/30, 70/50, B32B 27/12

(21) International Application Number: PCT/US00/25793

(22) International Filing Date:  
20 September 2000 (20.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/154,717 20 September 1999 (20.09.1999) US

(71) Applicant (for all designated States except US): HUNTER  
DOUGLAS INC. [US/US]; 2 Parkway, Upper Saddle  
River, NJ 07458-0740 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): COLSON, Wendell,  
B. [US/US]; 12 Tech Circle, Natick, MA 01760 (US).  
SWISZCZ, Paul, G. [US/US]; 12 Tech Drive, Natick,  
MA 01760 (US).

(74) Agents: LINEK, Ernest, V. et al.; Banner & Witcoff, Ltd.,  
28th floor, 28 State Street, Boston, MA 02109 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,  
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,  
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,  
LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ,  
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM,  
TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian  
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European  
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,  
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

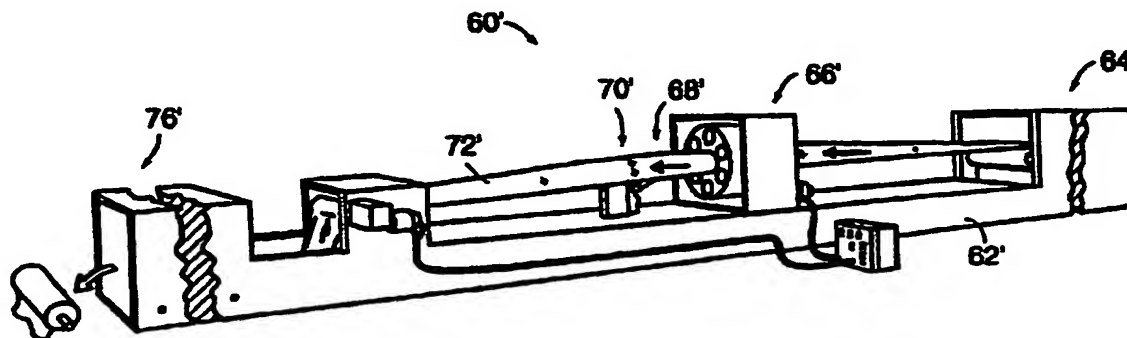
— with international search report

(88) Date of publication of the revised international search  
report: 19 July 2001

(15) Information about Correction:  
see PCT Gazette No. 29/2001 of 19 July 2001, Section II

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: NON-WOVEN COMPOSITE FABRIC AND METHOD AND APPARATUS FOR MANUFACTURING SAME



(57) Abstract: An apparatus for fabricating a unique non-woven fabric which has the appearance of a woven fabric includes a supply station for adhesive coated parallel warp yarns, a support structure for orienting the parallel warp yarns into a cylindrical orientation with the adhesive coating on the outside, a weft yarn applicator for wrapping weft yarns around the cylindrically oriented warp yarns, a heating station for activating the adhesive and a cooling station for setting the adhesive, and a cutter for severing the cylindrically formed fabric composite so that it can be flattened and wrapped onto a take-up roller. The weft yarn applicator includes a rotating drum wherein a plurality of spools of weft yarn material are mounted in circumferentially spaced relationship. Tension in the weft yarns is provided by the rotation of the drum (centrifugal force) and a stationary conical aligner is used to guide the weft yarn material onto the warp yarns in substantially perpendicular alignment.

WO 01/21383 A1

# PCT REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum) 4686/00005

## Box No. I TITLE OF INVENTION

NON-WOVEN COMPOSITE FABRIC AND METHOD AND APPARATUS FOR MANUFACTURING SAME

## Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

HUNTER DOUGLAS INC.  
2 Parkway  
Upper Saddle River, New Jersey 07458-0740  
United States of America

☐ This person is also inventor.

1-800-444-8844  
Telephone No.

1-201-327-5644  
Facsimile No.

Teleprinter No.

N/A

State (that is, country) of nationality: US

State (that is, country) of residence: US

This person is applicant ☒ all designated States ☐ all designated States except the United States of America for the purposes of: ☐ the United States of America only ☐ the States indicated in the Supplemental Box

## Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

COLSON, Wendell B.  
12 Tech Circle  
Natick, Massachusetts 01760  
United States of America

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality: US

State (that is, country) of residence: US

This person is applicant ☐ all designated States ☐ all designated States except the United States of America for the purposes of: ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

## Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf ☒ agent ☐ common representative of the applicant(s) before the competent International Authorities as:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LINEK, Ernest V.  
BANNER & WITCOFF, LTD.  
28 State Street, 28th Floor  
Boston, Massachusetts 02109  
United States of America

Telephone No.

(617)227-7111

Facsimile No.

(617) 227-4399

Teleprinter No.

N/A

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTORS****If none of the following sub-boxes is used, this sheet should not be included in the request.**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SWISZCZ, Paul G.  
12 Tech Drive  
Natick, Massachusetts 01760  
United States of America

This person is:

☐ applicant only☒ applicant and inventor☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality: US

State (that is, country) of residence: US

This person is applicant ☐ all designated States ☐ all designated States except the United States of America  
for the purposes of: ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

☐ applicant only☐ applicant and inventor☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant ☐ all designated States ☐ all designated States except the United States of America  
for the purposes of: ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

☐ applicant only☐ applicant and inventor☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant ☐ all designated States ☐ all designated States except the United States of America  
for the purposes of: ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

☐ applicant only☐ applicant and inventor☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant ☐ all designated States ☐ all designated States except the United States of America  
for the purposes of: ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

## Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

## Regional Patent

- ☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

## National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> AE United Arab Emirates                  | <input checked="" type="checkbox"/> LC Saint Lucia  |
| <input checked="" type="checkbox"/> AG Antigua and Barbuda                   | <input checked="" type="checkbox"/> LK Sri Lanka  |
| <input checked="" type="checkbox"/> AL Albania                               | <input checked="" type="checkbox"/> LR Liberia  |
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> LS Lesotho  |
| <input checked="" type="checkbox"/> AT Austria                               | <input checked="" type="checkbox"/> LT Lithuania  |
| <input checked="" type="checkbox"/> AU Australia                             | <input checked="" type="checkbox"/> LU Luxembourg   |
| <input checked="" type="checkbox"/> AZ Azerbaijan                            | <input checked="" type="checkbox"/> LV Latvia   |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina                | <input checked="" type="checkbox"/> MA Morocco  |
| <input checked="" type="checkbox"/> BB Barbados                              | <input checked="" type="checkbox"/> MD Republic of Moldova  |
| <input checked="" type="checkbox"/> BG Bulgaria                              | <input checked="" type="checkbox"/> MG Madagascar   |
| <input checked="" type="checkbox"/> BR Brazil                                | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia  |
| <input checked="" type="checkbox"/> BY Belarus                               | <input checked="" type="checkbox"/> MN Mongolia   |
| <input checked="" type="checkbox"/> BZ Belize                                | <input checked="" type="checkbox"/> MW Malawi   |
| <input checked="" type="checkbox"/> CA Canada                                | <input checked="" type="checkbox"/> MX Mexico   |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> MZ Mozambique   |
| <input checked="" type="checkbox"/> CN China                                 | <input checked="" type="checkbox"/> NO Norway   |
| <input checked="" type="checkbox"/> CR Costa Rica                            | <input checked="" type="checkbox"/> NZ New Zealand  |
| <input checked="" type="checkbox"/> CU Cuba                                  | <input checked="" type="checkbox"/> PL Poland   |
| <input checked="" type="checkbox"/> CZ Czech Republic                        | <input checked="" type="checkbox"/> PT Portugal   |
| <input checked="" type="checkbox"/> DE Germany                               | <input checked="" type="checkbox"/> RO Romania  |
| <input checked="" type="checkbox"/> DK Denmark                               | <input checked="" type="checkbox"/> RU Russian Federation   |
| <input checked="" type="checkbox"/> DM Dominica                              | <input checked="" type="checkbox"/> SD Sudan  |
| <input checked="" type="checkbox"/> DZ Algeria                               | <input checked="" type="checkbox"/> SE Sweden   |
| <input checked="" type="checkbox"/> EE Estonia                               | <input checked="" type="checkbox"/> SG Singapore  |
| <input checked="" type="checkbox"/> ES Spain                                 | <input checked="" type="checkbox"/> SI Slovenia   |
| <input checked="" type="checkbox"/> FI Finland                               | <input checked="" type="checkbox"/> SK Slovakia   |
| <input checked="" type="checkbox"/> GB United Kingdom                        | <input checked="" type="checkbox"/> SL Sierra Leone   |
| <input checked="" type="checkbox"/> GD Grenada                               | <input checked="" type="checkbox"/> TJ Tajikistan   |
| <input checked="" type="checkbox"/> GE Georgia                               | <input checked="" type="checkbox"/> TM Turkmenistan   |
| <input checked="" type="checkbox"/> GH Ghana                                 | <input checked="" type="checkbox"/> TR Turkey   |
| <input checked="" type="checkbox"/> GM Gambia                                | <input checked="" type="checkbox"/> TT Trinidad and Tobago  |
| <input checked="" type="checkbox"/> HR Croatia                               | <input checked="" type="checkbox"/> TZ United Republic of Tanzania  |
| <input checked="" type="checkbox"/> HU Hungary                               | <input checked="" type="checkbox"/> UA Ukraine  |
| <input checked="" type="checkbox"/> ID Indonesia                             | <input checked="" type="checkbox"/> UG Uganda   |
| <input checked="" type="checkbox"/> IL Israel                                | <input checked="" type="checkbox"/> US United States of America   |
| <input checked="" type="checkbox"/> IN India                                 | <input checked="" type="checkbox"/> UZ Uzbekistan   |
| <input checked="" type="checkbox"/> IS Iceland                               | <input checked="" type="checkbox"/> VN Viet Nam   |
| <input checked="" type="checkbox"/> JP Japan                                 | <input checked="" type="checkbox"/> YU Yugoslavia   |
| <input checked="" type="checkbox"/> KE Kenya                                 | <input checked="" type="checkbox"/> ZA South Africa   |
| <input checked="" type="checkbox"/> KG Kyrgyzstan                            | <input checked="" type="checkbox"/> ZW Zimbabwe   |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input type="checkbox"/> Check-box reserved for designating States which have become party to the PCT after issuance of this sheet: |
| <input checked="" type="checkbox"/> KR Republic of Korea                     |   |
| <input checked="" type="checkbox"/> KZ Kazakhstan                            |   |

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

**Supplemental Box** *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:

(i) if more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;

(ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;

(iii) if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;

(iv) if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;

(v) if, in Box No. V, the name of an State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;

(vi) if, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;

(vii) if, in Box No. VI, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.

2. If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.

3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.

Continuation of Box No. IV:

MCDERMOTT, Peter J.  
IWANICKI, John P.  
COHAN, Gregory J.

All members of the firm of BANNER & WITCOFF, LTD. at the address, telephone and telefacsimile numbers as indicated in Box No. IV.



<b>Box No. VI PRIORITY CLAIM</b>		<input checked="" type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
		Where earlier application is:		
Filing date of earlier application (day/month/year)	Number of earlier application	national application: country	regional application:* regional Office	international application: receiving Office
item (1)      20/09/99	60/154,717	US		
item (2)				
item (3)				
<p><input checked="" type="checkbox"/> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): (1)</p> <p>* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.</p>				
<b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>				
<b>Choice of International Searching Authority (ISA)</b> (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): <b>ISA/EPO</b>		<b>Request to use results of earlier search; reference to that search</b> (if an earlier search has been carried out by or requested from the International Searching Authority): Date (day/month/year)      Number      Country (or regional Office)		
<b>Box No. VIII CHECK LIST; LANGUAGE OF FILING</b>				
This international application contains the following number of sheets:  request : 5 sheets description (excluding sequence listing part) : 12 sheets claims : 4 sheets abstract : 1 sheet drawings : 7 sheets sequence listing part of description : sheets <b>Total number of sheets</b> : 29 sheets		This international application is accompanied by the item(s) marked below: 1. <input checked="" type="checkbox"/> fee calculation sheet (duplicate) 2. <input type="checkbox"/> separate signed power of attorney 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input checked="" type="checkbox"/> other (specify): Transmittal		
<b>Figure of the drawings</b> which should accompany the abstract: Fig. 1		<b>Language of filing of the international application:</b> ENGLISH		
<b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>				
Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).				
HUNTER DOUGLAS INC.		WENDELL B. COLSON		PAUL G. SWISZCZ
Name: _____ Title: _____				

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings:  <input type="checkbox"/> received:  <input type="checkbox"/> not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): <b>ISA/EP</b>	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

For receiving Office use only

PCT

**FEE CALCULATION SHEET**  
Annex to the Request

International application No.

Applicant's or agent's  
file reference 4686/00005

Date stamp of the receiving  
Office

Applicant HUNTER DOUGLAS INC.

**CALCULATION OF PRESCRIBED FEES**

1. TRANSMITTAL FEE

240 | T

2. SEARCH FEE

925 | S

International search to be carried out by  
(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

**Basic Fee**

The international application contains 136 sheets.

first 30 sheets

b<sub>1</sub> | 427

x 10.00 =

remaining sheets X additional amount

b<sub>2</sub> |

Add amounts entered at b<sub>1</sub> and b<sub>2</sub> and enter total at B

427 | B

**Designation Fees**

The international application contains 87 designations.

x 92.00 =

number of designation fees x amount of designation  
fee

736 | D

payable (maximum 8)

Add amounts entered at B and D and enter total at I  
(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

1,163 | I

4. FEE FOR PRIORITY DOCUMENT (if applicable)

15 | P

5. TOTAL FEES PAYABLE

Add amounts entered at T, S, I and P,  
and enter total in the TOTAL box

**TOTAL: USD \$2,343.00**

☐ The designation fee is not paid at this time.

**MODE OF PAYMENT**

☒ authorization to charge  
deposit account (see below)

☐ bank draft

☐ coupons

☐ cheque

☐ cash

☐ other (specify):

☐ postal money order

☐ revenue stamps

**DEPOSIT ACCOUNT AUTHORIZATION** (this mode of payment may not be available at all receiving Offices)

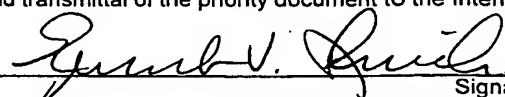
The RO/US ☒ is hereby authorized to charge the total fees indicated above to my deposit account.

☒ (this check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☒ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

19-0733  
Deposit Account Number

20 September 2000  
Date (day/month/year)

  
Signature:

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>4686/85377</b>	<b>FOR FURTHER ACTION</b> <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No. <b>PCT/US 00/ 00571</b>	International filing date (day/month/year) <b>10/01/2000</b>	(Earliest) Priority Date (day/month/year) <b>12/01/1999</b>
Applicant <b>HUNTER DOUGLAS INC. et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 03 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/00571

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4265691 A	05-05-1981	JP 1158766 C	25-07-1983
		JP 54125772 A	29-09-1979
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		BE 753524 A	31-12-1970
		CH 562902 A	13-06-1975
		DE 2030203 A	15-04-1971
		ES 382015 A	16-04-1973

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/00571

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3663331 A		FI 50348 B FR 2064186 A GB 1298267 A NL 7009158 A,B, NO 126140 B SE 373888 B	31-10-1975 16-07-1971 29-11-1972 14-04-1971 27-12-1972 17-02-1975
GB 1463969 A	09-02-1977	CA 998233 A AU 470279 B AU 8031375 A BR 7502436 A DE 2518525 A FR 2268895 A JP 971571 C JP 50160561 A JP 54004436 B ZA 7502072 A	12-10-1976 11-03-1976 11-03-1976 03-03-1976 20-11-1975 21-11-1975 27-09-1979 25-12-1975 06-03-1979 31-03-1976
WO 8002850 A	24-12-1980	NONE	

# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

# PCT

To:

BANNER & WITCOFF, Ltd.  
Attn. LINEK, E.  
28 State Street, 28th Floor  
Boston, Massachusetts 02109  
UNITED STATES OF AMERICA

COMMUNICATION IN CASES FOR WHICH  
NO OTHER FORM IS APPLICABLE

Date of mailing  
(day/month/year)

10/04/2001

Applicant's or agent's file reference

4686/00005

REPLY DUE

See paragraph 1 below

International application No.

PCT/US 00/ 25793

International filing date  
(day/month/year)

20/09/2000

Applicant

HUNTER DOUGLAS INC. et al.

1. ☐ REPLY DUE within \_\_\_\_\_ ~~xxxx~~ days from the above date of mailing

☒ NO REPLY DUE

2. COMMUNICATION:

The International Search Report mailed on 08/02/01 cited an incorrect IPC symbol.

Please find enclosed a new Search Report which cancels and replaces the one already in your possession.

We want to apologize for any inconvenience caused.

A copy of this letter and its enclosures has been sent to the International Bureau of W.I.P.O. in Geneva.

RECEIVED  
APR 23 2001  
E. V. LINEK

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
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Fax: (+31-70) 340-3016

Authorized officer

Monika Schmitz

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>4686/00005</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/US 00/ 25793</b>	International filing date (day/month/year) <b>20/09/2000</b>	(Earliest) Priority Date (day/month/year) <b>20/09/1999</b>
Applicant <b>HUNTER DOUGLAS INC. et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 03 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

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6. The figure of the **drawings** to be published with the abstract is Figure No.

- ☐ as suggested by the applicant.
- ☒ because the applicant failed to suggest a figure.
- ☐ because this figure better characterizes the invention.
- 2  
☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

International Application No

PO S 00/25793

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B29C53/80 B65H81/00 D04H3/07 D04H3/04 D04H3/12  
D06H7/08 B63H9/06 B29C70/30 B29C70/50 B32B27/12  
B29C67/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B29C B65H D04H D06H B63H B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 00 41523 A (HUNTER DOUGLAS IND BV ;HARTMAN DAVID (US); SWISCZ PAUL (US); HUNTE) 20 July 2000 (2000-07-20) cited in the application claims 35-47, 53-67, 95-99, 103-114, 128, 129 figures 1, 2, 8-11, 62-70 ---	1-18
A	US 4 511 424 A (USUI FUMIO) 16 April 1985 (1985-04-16) column 9, line 45 - line 61; figures 2, 4-10	9-16
Y	---	1-8, 17, 18
Y	US 2 797 728 A (G. SLAYTER ET AL) 2 July 1957 (1957-07-02) column 3, line 16 - line 20 column 6, line 62 - line 74 ---	1-8, 17, 18
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

\*A\* document defining the general state of the art which is not considered to be of particular relevance

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\*G\* document member of the same patent family

Date of the actual completion of the international search

24 January 2001

Date of mailing of the international search report

08/02/2001

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

Barathe, R



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/25793

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 80 02850 A (HONDA T) 24 December 1980 (1980-12-24) figures 2,3 ----	1-18
A	US 3 663 331 A (SOLBECK ERIK) 16 May 1972 (1972-05-16) figure ----	1-18
A	US 3 591 434 A (HARTSTEIN FRED W) 6 July 1971 (1971-07-06) the whole document ----	9-16
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A	US 5 061 545 A (PREVORSEK DUSAN C ET AL) 29 October 1991 (1991-10-29) figure 10 ----	9-16
A	EP 0 885 803 A (MCGHEE JAMES M) 23 December 1998 (1998-12-23) the whole document -----	13-16

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PO S 00/25793

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			EP 0445222 A	11-09-1991
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

P S 00/25793

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5061545 A		WO 9006387 A	14-06-1990
EP 0885803 A	23-12-1998	NONE	

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>4686/00002</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/US 00/ 25680</b>	International filing date (day/month/year) <b>20/09/2000</b>	(Earliest) Priority Date (day/month/year) <b>20/09/1999</b>
Applicant <b>HUNTER DOUGLAS INC. et al.</b>		

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☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1  
☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/25680

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B32B31/00 B30B5/06 D04H3/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B32B B30B D04H B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 01 210318 A (MITSUBISHI RAYON ENG CO LTD) 23 August 1989 (1989-08-23) figures	1, 16, 18
X	& PATENT ABSTRACTS OF JAPAN vol. 013, no. 519 (M-895), 20 November 1989 (1989-11-20) & JP 01 210318 A (MITSUBISHI RAYON ENG CO LTD), 23 August 1989 (1989-08-23) abstract ----- -/--	1, 16, 18

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\*Z\* document member of the same patent family

Date of the actual completion of the international search

22 January 2001

Date of mailing of the international search report

08/02/2001

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

Barathe, R

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/25680

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 63 267525 A (MITSUBISHI RAYON ENG CO LTD) 4 November 1988 (1988-11-04) figures	1,2,5,8, 12,18
X	& PATENT ABSTRACTS OF JAPAN vol. 013, no. 065 (M-797), 14 February 1989 (1989-02-14) & JP 63 267525 A (MITSUBISHI RAYON ENG CO LTD), 4 November 1988 (1988-11-04) abstract	1,2,5,8, 12,18
X	EP 0 255 596 A (MITSUBISHI RAYON ENG) 10 February 1988 (1988-02-10) figures	1,2,5,8, 12
P,X	WO 00 41523 A (HUNTER DOUGLAS IND BV ;HARTMAN DAVID (US); SWISCZ PAUL (US); HUNTE) 20 July 2000 (2000-07-20) cited in the application claims 130-143; figures 71-77	1-18, 21-24
X	US 4 687 528 A (HELD KURT) 18 August 1987 (1987-08-18) column 6, line 27 - line 44; figures	1
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X	DE 30 46 432 A (SANTRADE LTD) 19 August 1982 (1982-08-19) the whole document	1
X	US 4 498 941 A (GOLDSWORTHY WILLIAM B) 12 February 1985 (1985-02-12) the whole document	1
X	US 5 558 016 A (DE BROCK RAOUL) 24 September 1996 (1996-09-24) the whole document	1,18
A	US 3 591 434 A (HARTSTEIN FRED W) 6 July 1971 (1971-07-06) figures 1,7	1,24

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/25680

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
JP 01210318	A	23-08-1989	NONE		
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EP 0255596	A	10-02-1988	JP	1608262 C	28-06-1991
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			CN	1030045 A,B	04-01-1989
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			IN	171921 A	06-02-1993
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			LV	11139 A	20-04-1996
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			SU	1828438 A	15-07-1993
			US	5713271 A	03-02-1998
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US 3591434	A	06-07-1971	DE	1785175 A	05-01-1972
			FR	1595577 A	15-06-1970
			GB	1230586 A	05-05-1971

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>4686/00003</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/US 00/ 25681</b>	International filing date (day/month/year) <b>20/09/2000</b>	(Earliest) Priority Date (day/month/year) <b>20/09/1999</b>
Applicant <b>HUNTER DOUGLAS INC. et al.</b>		

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1

☐

None of the figures.



# INTERNATIONAL SEARCH REPORT

National Application No  
PCT/US 00/25681

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 D04H3/02 D04H3/12

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 D04H D02J B29C

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 00 41523 A (HUNTER DOUGLAS IND BV ; HARTMAN DAVID (US); SWISCZ PAUL (US); HUNTE) 20 July 2000 (2000-07-20) the whole document	1-20
X	GB 1 440 081 A (GOODYEAR TIRE & RUBBER) 23 June 1976 (1976-06-23) page 1, line 89 -page 3, line 89; claims	1-5, 10-14
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Y		8, 14, 17

☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

22 January 2001

Date of mailing of the international search report

08/02/2001

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

Barathe, R

# INTERNATIONAL SEARCH REPORT

Information on patent family members

national Application No

PCT/US 00/25681

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0041523 A	20-07-2000	AU 3692500 A	01-08-2000
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7/10/01

NON-WOVEN COMPOSITE FABRIC  
AND METHOD AND APPARATUS FOR MANUFACTURING SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority under 35 U.S.C. §119 from commonly owned provisional application, U.S.S.N. 60/154,717, filed 20 September 1999, the disclosure of which is hereby incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to non-woven fabric materials and, more particularly, to a composite fabric which includes at least two non-woven fabric layers; a first non-woven layer having yarns aligned in the machine direction; and a second non-woven layer having yarns aligned substantially perpendicular to the machine direction, along with an apparatus and method for manufacturing the same.

SUMMARY OF THE INVENTION

In the present invention, two non-woven yarn substrates are combined into a composite structure, which, after lamination, preferably pressure lamination, has a variety of uses. In particular, either before, or after lamination, the composite fabric of the present invention has the general

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appearance of a woven fabric.

Reference to the term yarn will be made throughout the description of the invention and the term should be broadly interpreted to include mono and multi-filament yarns and strands of material. The yarns may be large or small in diameter or denier, and can be made from many types of materials including but not limited to polyester, polyethylene, polypropylene, polyaramid and other polymers or plastics; wool, cotton, hemp and other natural fibers; blends of natural and/or synthetic fibers; glass, metal, graphite and the like. It is conceivable that some of the warp and/or weft yarns may be copper or aluminum wire. It should also be appreciated with the description that follows that various densities of warp or weft yarn wrap will be referenced and these densities will vary depending upon the type of yarn as described above and the desired characteristics of the non-woven product being manufactured.

Accordingly, one embodiment of this invention is directed to a composite fabric, which includes at least two non-woven fabric layers; a first non-woven layer having yarns aligned in the machine direction; and a second non-woven layer having yarns aligned substantially perpendicular to the machine direction.

Two additional embodiments of the present invention are (1) a continuous, in-line fabrication method and (2) apparatus for manufacturing such non-woven fabric.

The non-woven fabric of the present invention has the appearance of a woven fabric, but is considered a non-woven because the warp and weft yarns are not interlaced or interwoven, but instead are laid one over the other and adhered together.

One embodiment of the composite fabric of the present invention involves the use of warp yarns and weft yarns positioned substantially perpendicular to one another. The terms "substantially perpendicular" as used herein are meant

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to include angles that approximate 90 degrees, and include specifically a range of from about 85 to 95 degrees, preferably 87 to 93 degrees, more preferably 89 to 91 degrees and most preferably 89.5 to 90.5 degrees.

The two different yarns are adhered to one another with an adhesive material that is first set during the initial processing, and may be further set during pressure lamination. The yarn density can approach as high as 140 yarns per inch for a single strand 36 cotton count yarn. This is substantially higher than the density available in the same yarn count of a conventional woven fabric, which has a maximum yarn density of about 90 yarns per inch for the same yarn. The adhesive preferably represents less than 5-20% by weight of the entire structure.

The apparatus of the present invention includes a supply station for warp yarn material. For the purposes of this disclosure, warp yarn material will be any material or combination of yarns that has yarns or fibers primarily positioned to run in the machine direction of the apparatus and that are, at a minimum, coated with a thin coating of adhesive material. The apparatus further includes a warp yarn material delivery station where the warp yarn material is conformed longitudinally to the outer surface of a cylindrical support so as to extend longitudinally of the support, and a weft yarn application station through which the warp material passes. Once the composite fabric material (combined warp and weft yarns) has been formed, an adhesive situated between the non-woven fabric layers is heated and cooled to bond the layers. The bonded composite fabric material may be treated with high pressure and heat to make a more secure bond. However, this final pressure-bonding step is not mandatory, but it does increase the strength characteristics of the final composite product.

In the present invention, the weft yarn application station comprises an enclosed rotating drum that has a ring-like enclosure with a plurality of supplies of weft yarn material on separate individual spools, cones or the like. The drum has a cylindrical axial passage along its longitudinal axis through which the

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warp yarns with the overlying adhesive pass. The cylindrical axial passage is fitted with a conical aligner, which serves as the final guide for guiding the rotating weft yarns into position on the warp yarns in substantially perpendicular alignment. The conical aligner is a stationary unit, which has an angled or sloped surface directed toward the forward movement of the warp yarns. A slope ranging from about 30 to 60 degrees has been found to be effective, with a 45-degree slope being preferred.

Each of the weft yarns are delivered to a fixed point on the stationary conical aligner, and from that point each yarn falls down the slope of the aligner and finally falls into place on the cylindrical warp fabric yarns, landing on the adhesive on the exposed surface of the warp yarns. By use of the conical aligner of the present invention, the weft yarns do not overlap one another. Instead, the weft yarns bump one another down the aligner and onto the warp fabric, creating a tight packing of the individual fibers laid transversely around the adhesive and warp yarns as the drum rotates at about 500-600 rpm about its axis. Tension of the weft yarns is provided by the centrifugal rotation of the drum.

It will be appreciated that both the tensioning of the weft yarns and the conical aligner's guiding of the placement of the weft yarns at the surface of the warp yarn material, in conjunction with the rotation of the weft yarns around the warp yarn material results in very high accuracy of weft yarn placement. High accuracy of the yarn placement can result in high weft yarn packing density, uniformity of the weft yarn, structural engineering of the fabric based on known placement of the weft yarns, and overall improved performance of the product.

In a preferred embodiment of the apparatus, up to twelve spools of weft yarn material can be mounted within the rotating drum on a radial wall thereof even though the size of the drum can be increased or the density of the spools within the drum can be increased so as to allow for more or less than twelve spools. By providing twelve spools of material at a pre-determined equal

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circumferential spacing within the drum, the drum can be properly balanced so that it can be rotated at high rates of speed substantially without vibration. It is also important that the twelve spools, or however many are used, are at an exactly equal angular displacement relative to each other, for a uniform spacing of weft yarns. Exact angular displacement and the pushing of the weft yarns against the next adjacent weft yarn results in the weft yarns being precisely and controllably placed so as to optimize weft yarn packing. However, if a pattern is desired, this equal displacement could be modified.

The drum also has a separate power source for rotating the drum at a different speed than the power source at the take-up station in the apparatus, which advances the transfer belt and the warp yarn material through the apparatus. Accordingly, the warp yarn material can be moved linearly through the apparatus along the cylindrical support at a selected or varied rate of speed while the rate of rotation of the drum can be at an independent selected and variable speed. This allows the weft yarns to be wrapped around the warp yarn material at predetermined or desired spacing and also at an angle relative to the longitudinal axis of the warp yarn material. In other words, while the weft yarn material is wrapped substantially perpendicularly to the warp yarn material, in reality it is slightly offset from perpendicular and the angle of offset can be varied by varying the rate of rotation of the drum relative to the linear speed at which the warp yarn material is advanced through the drum. As the angle is varied, so is the average spacing of the weft yarns.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a flow-chart depicting the process of the present invention in which a source of aligned warp yarns is combined with a source of weft yarns and then an adhesive which binds the two yarn sources together is activated (heating and cooling) and thereafter a combined non-woven fabric product is collected at a take-up station. This material is useful "as is" or it may be further processed as described below.

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Fig. 2 is a diagrammatic side elevation of a preferred embodiment of the manufacturing apparatus of the present invention.

Fig. 3 is a fragmentary diagrammatic top elevation of the apparatus shown in Fig. 2 with the adhesive removed for clarity.

Fig. 4 is a fragmentary diagrammatic side elevation of the apparatus shown in Fig. 2.

Fig. 5 is an enlarged fragmentary section taken along line 8-8 of Fig. 4.

Fig. 6 is an enlarged fragmentary section taken along line 7-7 of Fig. 4.

Fig. 7 is an enlarged fragmentary section taken along line 10-10 of Fig. 6.

Fig. 8 is an enlarged fragmentary section taken along line 11-11 of Fig. 4 and having been rotate ninety degrees.

Fig. 9 is a side cutaway of the conical aligner showing how the weft yarns are delivered to the warp yarn surface in a tightly packed arrangement.

Fig. 10 is a perspective view showing the weft yarns being applied at wide spacing to the warp yarn cylinder, showing how the weft yarns slide down the conical aligner face to drop precisely down on the warp yarn material.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The non-woven fabric manufacturing apparatus 60 of the present invention is shown in Fig. 2 to include an elongated in-line framework 62 including a warp yarn material supply station 64, a weft yarn application station 66, a heating station 68, a cooling station 70, a flattening station 72, and a take-up station 76. From the take-up station, the composite non-woven fabric of



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this invention can either be used directly, for instance as a light filtering medium, or it can be pressure laminated into a high strength composite fabric, suitable for use under extreme conditions, e.g., as sail cloth fabric.

PCT Publication No. WO 00/41523 describes a non-woven warp yarn fabric material, which is one preferred layer of the composite fabric in the present invention. In general, this aspect of the PCT publication describes a preferred warp yarn material for use in the present invention. The substrate comprises a plurality of yarns that are formed into an aligned group, substantially parallel and equally spaced apart, and held together by a hot melt adhesive applied to one side of the fiber group. This fiber orientation, in which the fibers run in the machine direction, creates a non-woven fabric material substrate in which the fibers mimic warp yarns, which can be combined with one or more woven or non-woven fiber substrates and pressure laminated to create finished products that have superior strength characteristics but retain the visual impression and physical feel of a woven material.

PCT Publication No. WO 00/41523 also describes a pressure laminator for finalizing the processing of the composite material of the present invention. In general, this aspect of the PCT publication describes a dual belt driven, continuous pressure lamination apparatus that utilizes pressure, heat and cooling to bond at least two substrates (plies) with an adhesive between the layers of the substrates. This pressure laminator has been specifically designed to permit the permanent joining of at least two non-woven fabric substrates with an adhesive between the substrates, with little or no shrinkage occurring during the lamination process. The resulting non-woven fabric advantageously has the appearance of a woven fabric, but has superior strength characteristics there over.

As illustrated in Figs. 2 and 4, a warp yarn material 78 is provided on a supply roll 80 at the warp yarn material supply station 64. Once in place at the supply station 64 of the apparatus of the present invention the warp yarn material 78 is passed on an endless, recycling transfer belt 124, preferably of

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PTFE (Teflon®). A series of bars and folding points (not shown) convert the flat sheet of warp yarn material into a curved or cylindrical shape. This folding box equipment is known in the art, and once the warp yarn material has the general shape of a cylinder, with the adhesive layer on the outside or exposed surface, the warp yarns are ready to be over wrapped with the weft yarn material.

Once formed into a cylindrical shape, the warp yarn material is advanced through the weft yarn application station 66 at a pre-determined rate with the warp yarn adhesive coating positioned on the exterior surface of the cylindrically configured warp yarn material. As the warp yarn material passes through the weft yarn application station, a series of weft yarns 128 radially located on a rotating drum 130 an equal distance from one another are wrapped transversely around the cylindrically configured warp yarn material at a predetermined rate and the resultant composite structure of warp yarn material 78, adhesive coating 116 and weft yarns 128 is then advanced through the heating station 68 where the adhesive coating is melted so that the adhesive will bond the warp yarn material and the weft yarns.

Immediately thereafter the composite material passes through the cooling or adhesive setting station 70 where the adhesive is set so as to no longer be tacky. The bonded fabric composite 131 progresses from the cooling station to the take-up station 76, a cutter 132, preferably a rotary cutter, longitudinally severs the cylindrical composite fabric material and the cut composite fabric material progressively changes from its cylindrical orientation, back to a generally flat orientation in the flattening station 72. At the downstream end of the flattening station, the belt passes down and around a drive roller 133 that underlies the endless belt, where the belt is returned to the supply station 64 via tensioning roller 135 and idler rollers 137. The drive roller, through its driving engagement with the endless belt, thereby advances the warp yarn material through the apparatus.

Fig. 3 is another diagrammatic view looking down on the apparatus shown in Fig. 2. This view illustrates the longitudinal, or machine direction

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orientation of the warp yarn material as it enters the weft yarn application station 66 and the resultant non-woven composite fabric product 131 extending from the weft yarn application station toward the take-up station 76.

The supply of warp yarn material 78 is disposed on the transfer roll 90 at the supply station and the yarns or fibers in the material 78 extend in parallel side-by-side relationship. A suitable braking or friction system (not seen) prevents the roll 110 from rotating freely and thus overrunning. The material is passed over an idler roller 144 onto the driven, endless recycling PTFE (Teflon®) belt 124 that supports the warp yarn material and advances it through the weft yarn application station. The PTFE (Teflon®) belt conforms to the support structure 126 and slides over a stainless steel wear plate.

As seen in Fig. 5, at the weft yarn application station 66, the PTFE (Teflon®) belting 124 continues through the weft yarn application station and is supported by a rigid inner cylindrical ring 144 that extends substantially the full length of the weft yarn application station.

Fig. 5 illustrates the weft yarn application station 66, which includes an outer housing 146 having a rear or downstream wall 152 having an aligned circular opening 154 there through, a top wall 156, a bottom wall 158, and side walls 160. A rigid support ring 162 having a peripheral flange 164 at its upstream end is bolted or otherwise secured to the rear wall 152 of the housing and defines a cylindrical passage 166 through the weft yarn application station. An inner cylindrical surface of the support ring is circumferentially spaced from the belting as it extends through the weft yarn application station. The support ring carries at longitudinally spaced locations on its outer surface the inner races of large diameter thin section ball bearings 168 such as of the type provided by Kaydon Corp. of Sumter, South Carolina. Outer races of the ball bearings respectively support another cylindrical body 170 that forms the inner cylindrical wall of the rotating drum. The inner cylindrical wall of the rotating drum supports a front radial wall 172 at the upstream end of the drum and radial wheel 194 at the downstream end of the drum, and the radial walls

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support an outer cylindrical wall 176 of the drum. The radial wheel 194 has guideposts 195 on the outer edges for delivering the weft yarns to the warp ring. The innermost portion of the radial wheel terminates at the conical aligner 200, which has a radiused, curved or sloped surface. The conical aligner 200 guides the weft yarns into a substantially perpendicular alignment with the warp yarns.

As shown in Fig. 7, a variable speed electric motor 178, serving as power means for the weft yarn application station, is mounted on the upstream face of the front wall 148 of the housing and has a drive shaft 180 that extends into the interior of the housing and supports a drive pulley 182 that is aligned with one of the ball bearings 168. The inner cylindrical wall 170 supports a pulley 186 around which a drive belt 188 extends so as to operably interconnect the drum with the drive pulley 182 of the electric motor. Energization of the electric motor thereby rotates the drum at variably selected speeds. The details of the mounting of the ball bearing and drive belt is probably best seen in the enlarged view in Fig. 7.

A plurality of source supplies of weft yarn material are provided in the form of spools 200 of such material and are removably mounted on the inner surface of the front wall 172 of the rotating drum, again in circumferentially spaced relationship and alignment with the circular openings 190 in the rear wall of the drum. It should be appreciated that the number of spools of weft yarn material could vary and while the disclosed embodiment shows six such spools, more or less could be used, in a preferred embodiment, twelve such spools are used. The weft yarn material is extended from a spool 206 to the eyelet 198 on disk 194 and then passed radially inwardly down the face of disk 194 to another eyelet at the base of disk 194. This is best seen in Figs. 9 and 10.

As the weft yarn application drum rotates, the weft yarns are delivered through eyelet 204 on disk 194, and the yarns slip down the curved slope of the conical aligner 200, by which each yarn is delivered to the warp in a

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substantially perpendicular alignment. Fig. 9 best illustrates the conical aligner of the present invention. As shown therein, the conical aligner 200 is a stationary device, with a surface angle or slope, which faces the direction of travel of the warp yarn materials. The weft yarns are delivered to the surface of the conical aligner by rotatory pulleys operating in conjunction with the rotating drum. The individual weft yarns are each delivered to substantially the same spot on the sloped surface of the conical aligner. They fall down the sloped surface, and are forced, one after the other, down into a tight spacing on the surface of the adhesive coated warp yarns. Fig. 10 shows a perspective view of the application of weft yarns, in a wide spacing manner, to the warp yarns. Once the weft yarns have been applied to the warp yarn material, the adhesive between the yarns must be heated and cooled to form a non-woven fabric. These steps are conducted in the next part of the apparatus as discussed below.

The adhesive heating station 68 consists of a steel or other heat transmitting cylindrical core 272 that is positioned interiorly of the belt 124 immediately downstream from the weft yarn material application station 66 and forms an axial extension of the rigid cylindrical ring 162 in the weft yarn application station. Resistive heat elements 274 are circumferentially positioned around the steel core 272 with the resistive heat elements connected to an electrical source by wiring 276 as possibly best seen in Fig. 6, which passes through the cylindrical ring support in the weft yarn application station and outwardly of the apparatus through a circular aperture 278 therein so that it can be plugged into an electrical power source in a conventional manner. When an electrical current is applied to the resistive elements, the metal core 272 is heated thereby radiating heat outwardly through the warp yarn material, the adhesive on the warp yarn material, and the overlying layer of weft yarn material. The heat is controlled to sufficiently melt the adhesive to bond the warp and weft yarns together.

As the composite fabric material 131 of bonded warp and weft yarns is moved downstream, it next encounters the cooling or adhesive setting station 70 which, again, includes a steel or other heat conductive cylinder 280 which

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immediately underlies the belt 124. A heat transfer system 282 interiorly of the cylinder 280 uses circulating coolant from inlet and outlet tubes 284, respectively, in a conventional manner to remove heat from the composite fabric material. The coolant transfer tubes (not shown) are connected to the heat transfer system so that a continuous supply of coolant fluid can be circulated through the cooling station to set the adhesive thereby securely bonding the warp and weft yarn material.

As the composite fabric material 131 leaves the cooling station 70 and is moved further downstream, it engages the fabric cutter 132 that is conventional and is mounted on a bracket 286. The cutter serves to sever the composite fabric material 131 along its length as it is moved along the apparatus.

As the material progresses further downstream after being cut, it is flattened out as the support structure 126 transgresses from a cylindrical configuration to a flat configuration in the flattening station 72. Accordingly, as the non-woven composite fabric material reaches the drive roller 133 and then passes to the take-up station 76, it has been flattened on the belt 124 and is wrapped around the take-up roll 136 until a desired amount of fabric material has been accumulated. The take-up roller can then be removed from the machine and replaced with another take-up roller to continue the process.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made by way of example, and changes in detail or structure may be made without departing from the spirit of the invention as defined in the appended claims.

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WHAT IS CLAIMED IS:

1. An apparatus for forming a non-woven fabric product having substantially perpendicular warp yarns and weft yarns, said apparatus comprising in combination,

a warp yarn support system including an elongated substantially cylindrical support structure having a low friction outer substantially cylindrical surface,

a supply of elongated parallel warp yarns positioned side-by-side along the length of said substantially cylindrical surface, said warp yarns having a coating of adhesive on their exposed surface,

a delivery system for weft yarn material including a drum mounted for rotation about said support structure, power means for rotating said drum about said support structure, at least one source supply of weft yarn material mounted on said drum for rotation therewith, and a guide system for delivering said weft yarn material from said source supply to said adhesive coated outer surface of said warp yarns, upon rotation of said drum such that said weft yarn material is wrapped around said warp yarns in substantially perpendicular relationship therewith,

a driven take-up system downstream from said weft yarn delivery system operatively connected to said warp yarns for moving said warp yarns along said support structure and through said weft yarn delivery system, and

a heater downstream from said weft yarn delivery system for activating said adhesive to bond said wrapped weft yarn material to said warp yarns,

wherein said driven system and said power means for rotating said drum are independently operated and at least one is variably driven such that the angle of wrap of said weft yarn material relative to the warp yarns is variable.

2. The apparatus of claim 1, wherein said source supplies of weft yarn material are spools of the weft yarn material.

3. The apparatus of claim 1, wherein said drum comprises a hollow ring surrounding said cylindrical support structure having a radial wall with

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inner and outer surfaces and a spaced apart radial wheel interconnected with said radial wall and said source supplies of weft yarn material are mounted on the inner surface of said radial wall.

4. The apparatus of claim 3, wherein weft yarn material from each of said source supply is fed to said radial wheel radially inwardly along said radial wheel to the warp yarns on said cylindrical support structure.

7. The apparatus of claim 6, wherein said radial wheel further includes a conical alignment guide positioned immediately adjacent to said warp yarns and around which said weft yarns extend prior to being wound around said warp yarns.

8. The apparatus of claim 1, wherein said weft yarn material is wrapped about said warp yarns so as to establish 40-100 wraps of weft yarn material per inch along the length of said warp yarns.

9. A non-woven fabric comprised of one layer of warp yarns and a second layer of substantially perpendicular weft yarns, the density of at least one of said warp yarns and weft yarns in the fabric being in the range of 40-140 yarns per inch.

10. The fabric of claim 9, wherein the density of both said warp yarns and weft yarns in the fabric is in the range of 40-140 yarns per inch.

11. The fabric of claim 9 or 10, wherein the denier of said warp and weft yarns is different.

12. The fabric of claim 9 or 10, wherein the denier of said warp and weft yarns is the same.

13. A non-woven sail cloth fabric comprised of a layer of warp yarns and a layer of substantially perpendicular weft yarns adhesively secured



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together, said adhesive constituting 5-20% of the weight of the non-woven fabric.

14. The sail cloth fabric of claim 13, wherein the density of at least one of said warp yarns and said weft yarns in the fabric is in the range of 40-100 yarns per inch.

15. The sail cloth fabric of claim 14, wherein the density of both said warp yarns and weft yarns in the fabric is in the range of 40-100 yarns per inch.

16. The sail cloth fabric of claims 13, 14, or 15, wherein the denier of said warp and weft yarns is different.

17. A method of forming a non-woven product having warp yarn material in a first direction and weft yarn material in a substantially perpendicular direction to said warp yarns, said method including the steps of:  
supplying a plurality of substantially parallel warp yarns longitudinally of their length in said first direction, said warp yarns having a coating of adhesive on one side thereof;

supporting said plurality of warp yarns, with said adhesive coating exposed, in longitudinally moving relationship and in a side-by-side arrangement along the length of an elongated substantially cylindrical support surface;

wrapping at least one individual weft yarn to and around the radially outermost surface of the warp yarns in a substantially perpendicular relationship therewith;

moving the warp yarns along the support surface for downstream collection subsequent to the wrapping step;

heating and thereby activating the adhesive to bond the wrapped weft yarns to the warp yarns.

18. The method of claim 17, wherein the weft yarns are wrapped about the warp yarns so as to establish 40 to 100 wraps per inch of weft yarns along

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the length of the warp yarns.

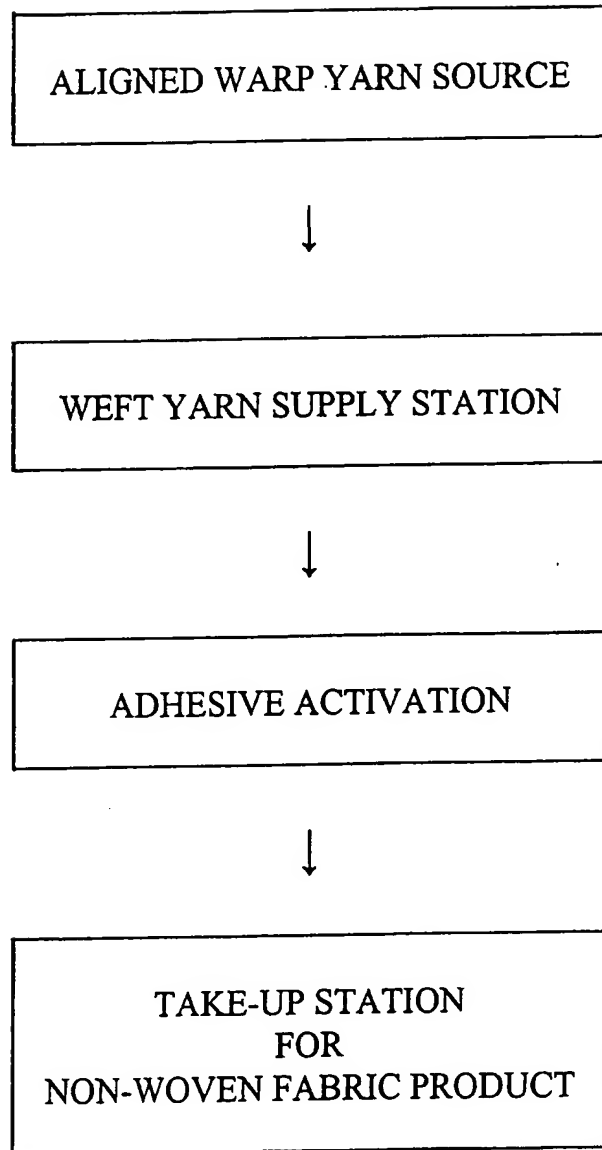


FIG. 1

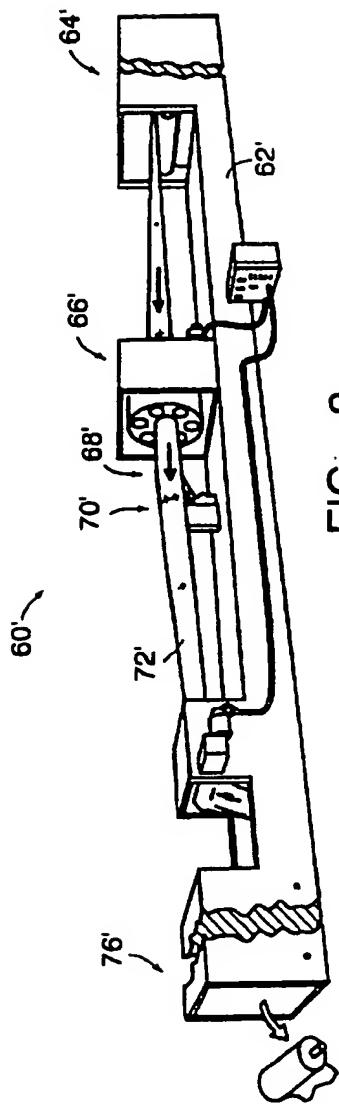


FIG. 2

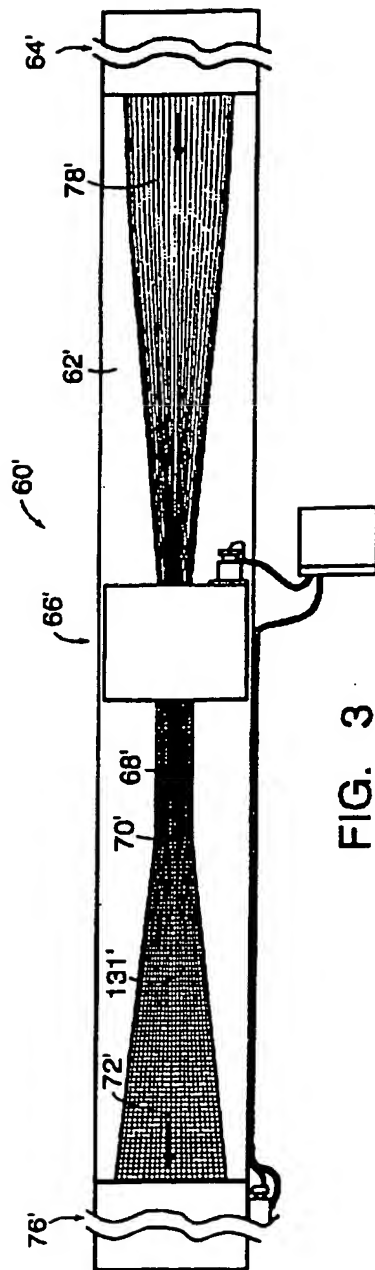


FIG. 3

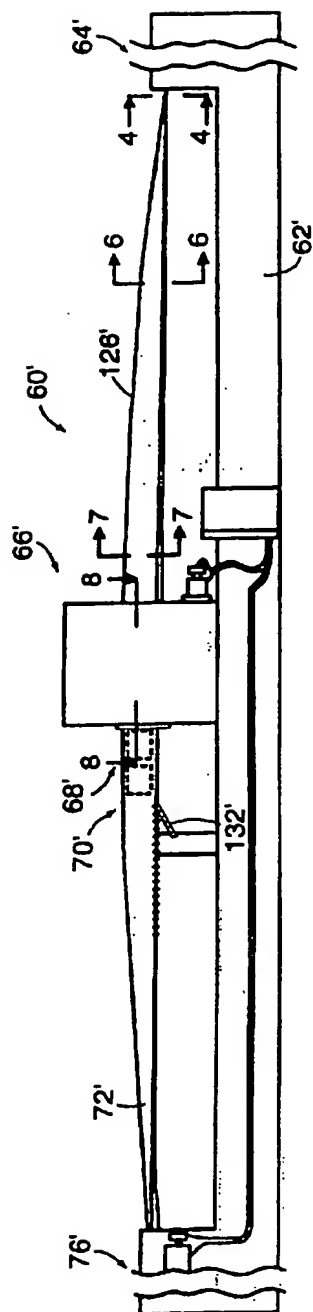


FIG. 4

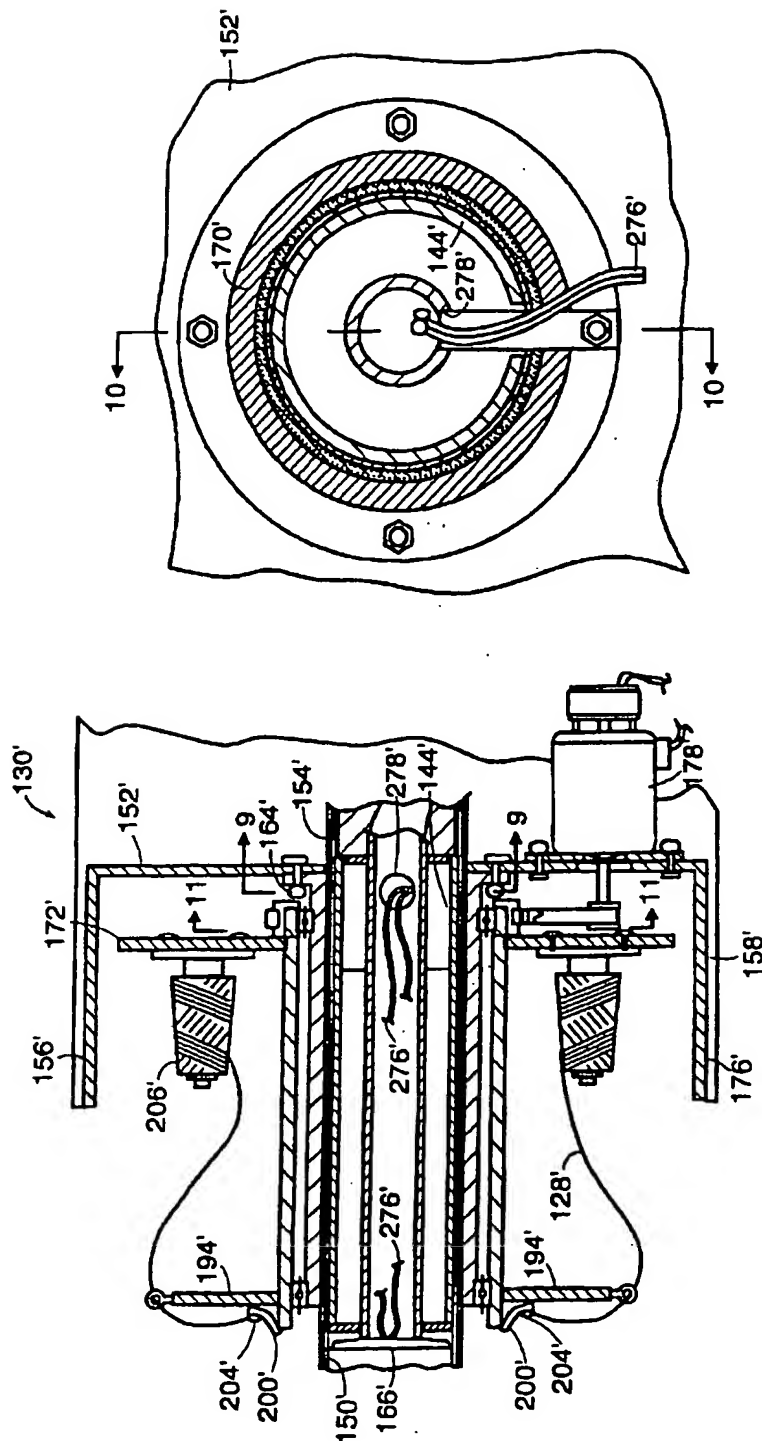


FIG. 6

FIG. 5

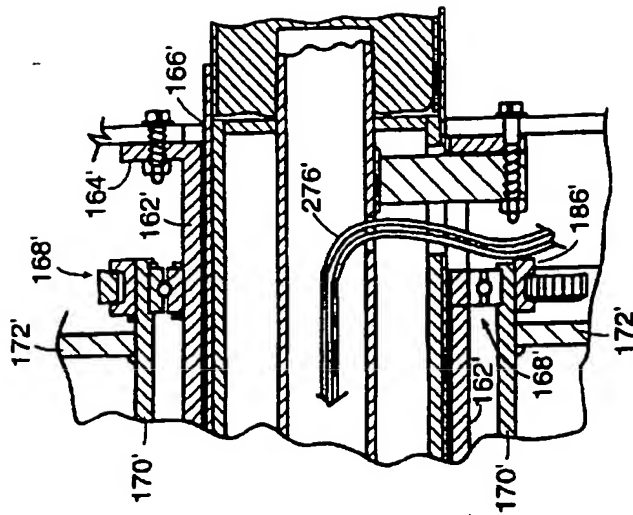


FIG. 8

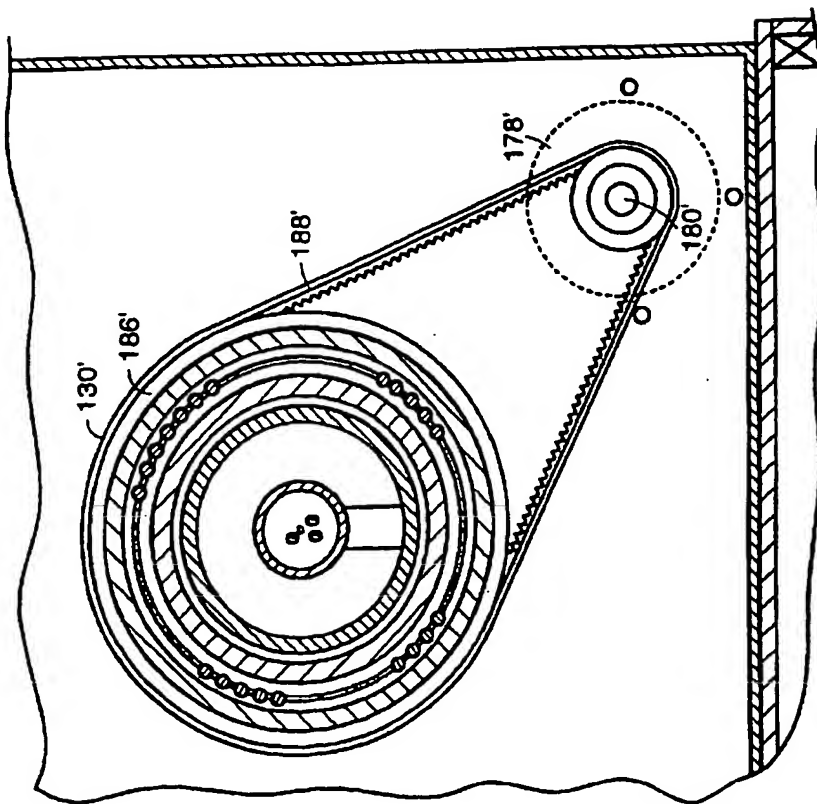


FIG. 7

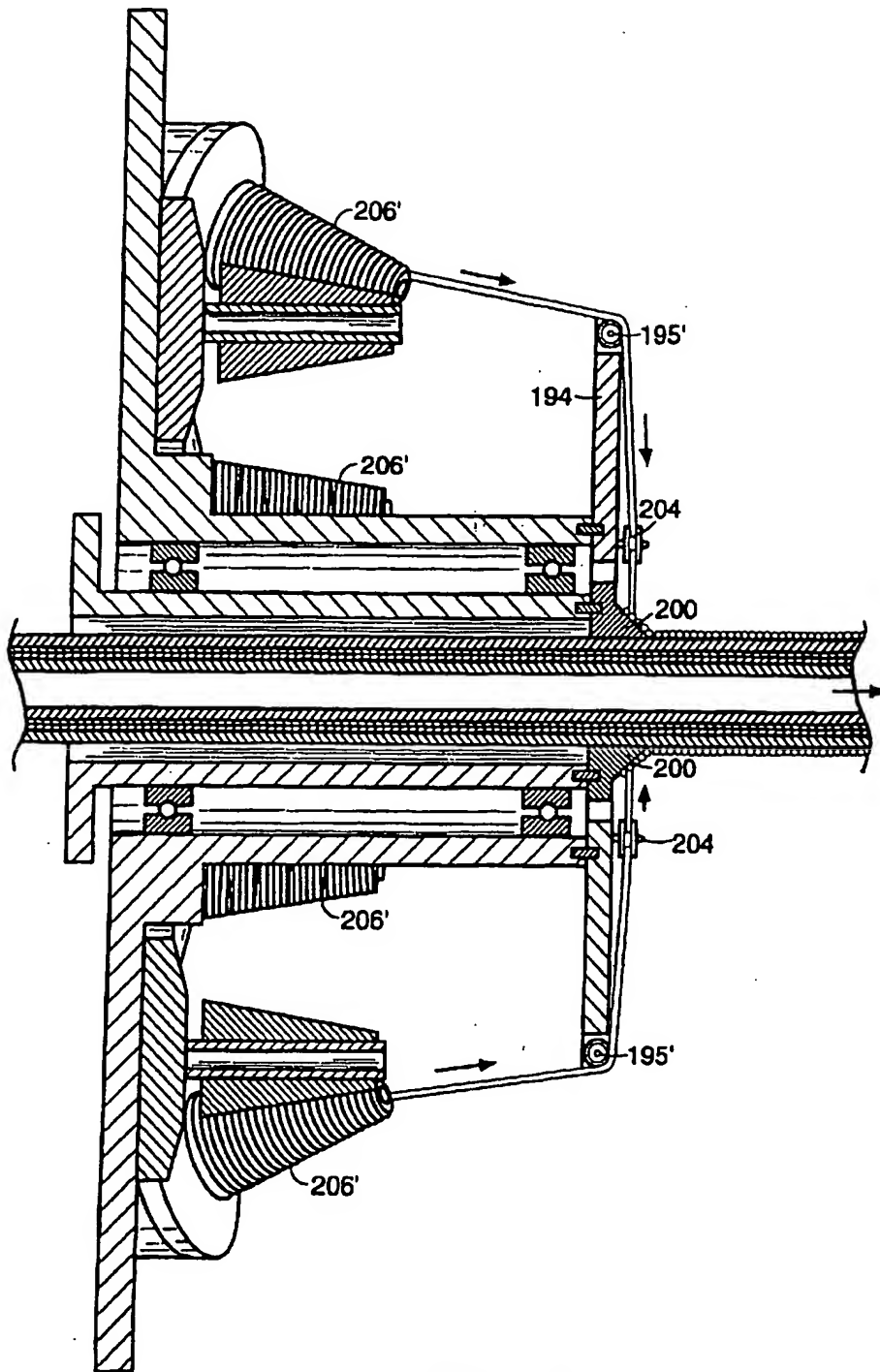


FIG. 9



